6-1-1992

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COOPERATIVE EXTENSION SERVICE
SDSU

Extension Extra

37ExEx 8079
June 1992
Plant Science

COLLEGE OF AGRICULTURE & BIOLOGICAL SCIENCES / SOUTH DAKOTA STATE UNIVERSITY / USDA

First Generation European Corn Borer Management

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The European corn borer is a destructive pest of corn in the Midwest. Larvae feed on leaves and tunnel into stalks and ear shanks. Stalk tunneling often interferes with nutrient transport and predisposes these plants to lodging. Additionally, yields may be impacted from damage to corn shanks thus leading to late-season ear drop. Although the corn borer damages corn each year, it is largely ignored by many South Dakota growers.

Life Cycle

There are two generations of corn borer in South Dakota. First-generation control is discussed in this publication; second generation control will be discussed in a subsequent publication.

European corn borers overwinter as fully mature larvae in corn stalks and other crop residue. As temperatures increase above 50° F, physiological development continues and larvae enter the pupal or resting stage. Adults emerge from the pupal cases and move from corn fields to areas referred to as action sites. Action sites include locations with grassy or weedy vegetation such as fencerows, shelterbelts, or field margins. Moths rest in these areas by day, mate and move into corn fields at night to lay eggs.

Eggs are deposited on the underside of the corn leaf near the midrib in groups of from 15 to 35 and resemble fish scales. A female is capable of depositing two egg masses per day for about 10 days. Incubation ranges from 4 to 6 days depending on temperature. Prior to hatching, eggs appear to be black due to the head capsule of the developing larvae.

Newly hatched larvae are cream colored, feed on leaf surfaces during early development, then crawl down into the whorl or leaf axils, and feed on leaf tissue within the whorl. When larvae reach the third instar, they tunnel into the stalk. Once larvae tunnel into the stalk, they are almost impossible to control with insecticides. Larvae complete their development within the stalk, pupate, and emerge as adults for the second generation.

Damage

Yield reduction to corn is significant and is two-fold in nature.

Physiological loss results when first-generation borers tunnel into the stalk and interfere with nutrient transport. Physiological yield loss varies depending on what stage of corn is attacked; most Midwest averages report about 5% yield loss per borer per stalk, up to a maximum of six borers per stalk. However, some South Dakota data suggest physiological yield losses as high as 8 to 10% per borer per stalk. If borers are allowed to tunnel in the stalk, physiological loss occurs irrespective of lodging or ear drop.

Harvest loss occurs when corn lodges or ears drop because of corn borer tunneling in the stalk or shank, and harvest equipment is not able to pick up the corn.

Remember, even if you harvest early and avoid harvest loss, physiological loss has already occurred if larvae are in the stalk.

Scouting

Begin scouting for first generation corn borer when corn is approximately 17 inches extended leaf height (top leaf is pulled up and measured from ground to leaf tip). Before corn is about 22 to 35 inches extended leaf height, damage by larvae will not be too significant. Corn at this stage has fairly high levels of a naturally occurring compound called DIMBOA which causes larvae to wander off the plant and not feed. As the corn plant increases in height, concentrations of DIMBOA decrease and larvae begin to feed.

To scout a 40 acre corn field, visit at least five locations throughout the field. Examine 20 consecutive plants at each location for a total of 100 plants per 40 acres. Record the percentage of plants that have whorl feeding or shotholing damage. This damage typically appears as small, circular holes in the leaves. In addition, dissect the whorl of at least 2 plants per location and record the number of live larvae in the whorl.

If you're using an economic model calculation to determine the threshold, you need to examine at least 50 whorls to determine the average number of larvae per plant. Even if feeding damage is evident, live larvae must be present in the whorl to justify insecticide treatments. Choose locations within the field that are representative of the over all field. Do not take samples within 100 feet of the field margin.

Scout fields at least weekly, but when eggs are hatching and a control decision is approaching, scout fields on a 3 to 5 day interval.

Economic Thresholds

There are two types of thresholds: static and calculated. Static thresholds are based on the percentage of plants that have whorl feeding damage. They are easy to use, but they may not be as realistic as the calculated thresholds. Static thresholds for first generation corn borer are presented in Table 1. Unfortunately, by the time 50% of the plants exhibit shotholing, some larvae have probably already entered the stalk and damage has occurred.

Calculated thresholds may be a better approach. They are based on a number of factors including percentage of plants infested, number of larvae per plant, expected crop yield, expected crop value, expected control, and cost of control. These thresholds are more applicable to individual situations, but are only as good as the estimates that go into their calculation.

Table 1. Static thresholds for first generation European corn borer.

	Percentage of plants with shotholing
Dryland Corn	50%
Irrigated Corn	35%
Seed Corn	5 to 10%

Table II shows the formula for calculating preventable loss. Scout the field to obtain the percentage of plants infested and average number of larvae per plant to make the first calculation. Use the answer for calculation 1 for calculation 2 and continue with estimates to work through the six calculations. As a general guideline, use 5% loss per borer, 80% control for granules, and 60% control for a liquid formulation applied aerially.

Example: A grower scouts his field and determines that 75% of the plants have shotholing. He examines 50 whorls and finds 75 live larvae, an average of 1.5 per plant. He estimates corn to be worth $2.20 per bushel, he estimates a 140 bushel yield, and it will cost him $10 per acre to treat.

He estimates a profit of $3.73 per acre by treating corn borer.

Table II. Calculating profit or loss for first-generation corn borers.

1. Calculate Borers/Plant:

_____	x	_____	=	_____
%Plants Infested		Average Borers/Plant		Borers/Plant

2. Calculate Percent Yield Loss:

_____	x	_____	=	_____
Borers/Plant		% Yield Loss/Borer		% Yield Loss

3. Calculate Bushel Loss per Acre:

_____	x	_____	=	_____
% Yield Loss		Expected Yield		Bushel Loss/Acre

4. Calculate Dollar Loss per Acre:

_____	x	_____	=	_____
Bushel Loss/Acre		Price/Bushel		Dollar Loss/Acre

5. Calculate Preventable Loss:

_____	x	_____	=	_____
Dollar Loss/Acre		% Control		Preventable Loss/Acre

6. Calculate Profit or Loss from Control:

_____	-	_____	=	_____
Preventable Loss/Acre		Control Cost		Profit or loss

Table II Example. Calculating profit or loss for first-generation corn borers.

1. Calculate Borers/Plant:

.75	x	1.5	=	1.125
%Plants Infested		Average Borers/Plant		Borers/Plant

2. Calculate Percent Yield Loss:

1.125	x	5%	=	5.6
Borers/Plant		% Yield Loss/Borer		% Yield Loss

3. Calculate Bushel Loss per Acre:

.056	x	140	=	7.8
% Yield Loss		Expected Yield		Bushel Loss/Acre

4. Calculate Dollar Loss per Acre:

7.8	x	2.20	=	$17.16
Bushel Loss/Acre		Price/Bushel		Dollar Loss/Acre

5. Calculate Preventable Loss:

$17.16	x	.80	=	$13.73
Dollar Loss/Acre		% Control		Preventable Loss/Acre

6. Calculate Profit or Loss from Control:

$13.73	-	$10.00	=	$3.73
Preventable Loss/Acre		Control Cost		Profit or loss

Control

Historically, granular formulations have outperformed liquid formulations for first-generation European corn borer control. However, recent research indicates that liquids also can be effective in controlling first generation corn borers. Table III list compounds registered for first generation corn borer control.

Table III. Chemicals Registered for European Corn Borer Control, 1992.

Insecticide	Formulation	AI/Acres	Preharvest Intervals
Bacillus thuringiensis (Dipel)	10 G, ES	1 lb	No preharvest interval
Carbaryl (Sevin)	XLR Plus	1.5-2 lb	No preharvest interval
Carbofuran (Furadan)	15G 4F	1 lb	30 day preharvest interval No more than 2 applications
Chlorpyrifos (Lorsban)	15G 4E	1 lb	35 days for livestock fodder or grain 14 days for grazing or silage
esfenvalerate (Asana)	0.66EC	0.04-0.05 lb	21 days
fonofos (Dyfonate)	20G	1 lb	30 days
methyl parathion (Penncap-M)	2 FM	0.5-1 lb	12 days for forage or feeding
permethrin (Pounce, Ambush)	1.5G,3.2EC	1-0.2 lb	Do not apply after brownsilk
phorate (Thimet)	20G	1 lb	30 days for grazing or forage
terbufos (Counter)	15G, 20CR	1 lb	30 days for grazing or forage. Cultivation time only if planting time treatment not used.

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